

AMENDMENTS TO THE CLAIMS

This listing of claims replaces all prior versions of claims in the application.

Claim 1 (Currently Amended) A circuit pattern inspection apparatus for inspecting an inspection target pattern by supplying an AC inspection signal to said inspection target pattern among a plurality of conductive target patterns having first and second opposite ends included each having a certain width and formed into approximately a bar-shape in an inspection target region with vicinities of both ends thereof and arranged in lines, which is adapted to supply an AC inspection signal from the first end side of said inspection region of said target patterns, and detect a signal from the second end side of said inspection region arranged in line and detecting a signal from said inspection target pattern, said circuit pattern inspection apparatus comprising:

supply means including a supply electrode for supplying said inspection signal from the first end side of said inspection region of said to one end of said inspection target pattern;

detection means including a sensor electrode for detecting a signal from each of said target patterns having a width corresponding to a width of at least two lines of said inspection target patterns, said sensor electrode being capacitively coupled with said inspection target pattern to which said inspection signal is supplied and a pattern adjacent to said inspection target pattern to which said inspection signal is supplied; and

first moving means for moving said supply electrode and sensor electrodes, respectively, with a given gap relative to each of said target patterns, across said first and second ends included in said inspection region and arranged in lines said sensor electrode mounted on respective

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moving support members across said both ends of said inspection target pattern with each electrode apart from said inspection target pattern in a state in which each electrode is capacitively coupled with opposed inspection target pattern;

wherein said first supply electrode and said sensor electrode are each capable of maintaining a nonzero distance, relative to said moving means moves in such a manner that said supply electrode and said sensor electrode synchronously pass above one end and the other end of the same inspection target pattern, and wherein said detection means detects a defect of said inspection target pattern due to its disconnection or short-circuit from said inspection signal obtained from a change of said capacity coupling between said inspection target pattern and said pattern adjacent to said inspection target pattern.

Claim 2 (Currently Amended) The circuit pattern inspection apparatus as defined recited in claim 1, wherein each of said target patterns is a conductive pattern formed on a circuit board, said conductive pattern having a bar-like shape with a given width further comprising determination means which judges to be normal when a detected result by said detection means falls within a prescribed range and judges to be abnormal when said detected result falls outside said prescribed range.

Claim 3 (Currently Amended) The circuit pattern inspection apparatus as defined in claim 1 or 2, wherein said sensor electrode has a width equal to or greater than a width of two lines of said target patterns recited in claim 2, further comprising:

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second moving means for moving one of said supply electrode and said sensor electrode along said inspection target pattern with the other fixed with respect to said both ends of said inspection target which said judging means judges to be a defect when said supply electrode and said sensor electrode are faced with each other by said first moving means; and position detection means for detecting a detection change position in said detection target pattern based on a detected result by said detection means,
whereby a location of said defect is detected.

Claim 4 (Currently Amended) The circuit pattern inspection apparatus as ~~defined in claim 1 or 2, wherein said sensor electrode includes:~~

~~a first sensor electrode adapted to be disposed at a position opposed to the second end of one of the adjacent target patterns which has the first end supplied with the inspection signal from said supply electrode; and~~

~~a second sensor electrode adapted to be disposed at a position opposed to the second end of a remaining one of said adjacent target patterns recited in claim 3, further comprising image taking means mounted on said moving support member.~~

Claim 5 (Currently Amended) The circuit pattern inspection apparatus as ~~defined in claim 4, wherein said first sensor electrode has a width equal to or less than each width of said target patterns as recited in claim 3, further comprising gap control means for performing a positioning control so that a distance between at least one of said supply electrode and said~~

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detection electrode moved with said second moving means and said inspection target pattern is kept approximately constant.

Claim 6 (Currently Amended) The circuit pattern inspection apparatus as defined in claim 4, wherein said second sensor electrode has a width equal to or less than each width of said target patterns recited in any one of claims 1 to 5, further comprising gap control means for performing a positioning control so that a distance between at least one of said supply electrode and said detection electrode moved with said first moving means and said inspection target pattern is kept approximately constant.

Claim 7 (Currently Amended) The circuit pattern inspection apparatus as defined in claim 1 or 2, wherein said moving means is adapted to move said supply and sensor electrodes, respectively, across said first and second ends included in said inspection region and arrange in lines, under the condition that each surface of said supply and sensor electrodes is capacitively coupled with each of said target patterns recited in claim 6, wherein said gap control means is equipped with a displacement measurement device disposed at a position adjacent to said sensor electrode or said supply electrode and adapted to be moved together with said sensor electrode or said supply electrode, and wherein said gap control means performs a positioning control in a direction orthogonal to said inspection target pattern in accordance with a detection result of said displacement measurement device so that a gap between said sensor electrode or said supply electrode and said inspection target pattern is kept approximately constant.

Claim 8 (Currently Amended) The circuit pattern inspection apparatus as defined in claim 1 or 2, which further includes determination means operable, when a detection result of said detection means based on a detection signal from one of said target patters is in a given acceptable range, to determine that said target pattern is normal, and, when a detection result of said detection means based on a detection signal from one of said target patters is out of said given acceptable range, to determine that said target pattern is defective recited in claim 7, wherein said gap control means performs a positioning control in a direction orthogonal to said inspection target pattern, on the basis of a gap between said sensor or supply electrode and said inspection target pattern which is defined by an average displacement of detection results of said displacement measurement device between a plurality of pitches of said inspection target patterns.

Claim 9 (Currently Amended) [[The]] A circuit pattern inspection apparatus as defined in claim 8, which includes:

second moving means for moving said supply and sensor electrodes to respective positions opposed to the first and second ends of said defective target pattern determined by said determination means, and moving either one of said supply and sensor electrodes along said defective target pattern toward the other electrode; and

position detection means for detecting a position where a detection signal from said defective target pattern has a change, in accordance with a detection result of said detection

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means method for checking quality of a plurality of conductive inspection target patterns each having a certain width and formed into an approximate bar-shape in an inspection target region with vicinities of both ends thereof arranged in line using a circuit pattern inspection apparatus comprising supply means having a supply electrode for supplying an AC inspection signal to at least one of detection target patterns among said plurality of conductive inspection target patterns and detection means having a sensor electrode for detecting a signal from said inspection target pattern, said sensor electrode having a width corresponding to a width of at least two lines of said inspection target patterns, the method comprising:

supplying said inspection signal to said inspection target pattern spaced apart from said supply electrode, said detection means being spaced apart from and capacitively coupled with at least two rows of patterns of said inspection target pattern and a pattern adjacent to said inspection target pattern;

synchronously moving said supply electrode and said sensor electrode so as to pass over one end and the other end of the same inspection target pattern while maintaining said capacitively coupled state; and

detecting a defect of said inspection target pattern due to its disconnection or short-circuit from said inspection signal obtained from a change of said capacity coupling between said inspection target pattern and said pattern adjacent to said inspection target pattern.

Claim 10 (Currently Amended) The circuit pattern inspection apparatus as defined in claim 9, which includes contacting means for bringing either one of said supply and sensor

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~~electrodes into contact with said defective target pattern method as recited in claim 9, wherein said inspection target pattern is judged to be normal when a detected result by said detection means falls within a prescribed range and judged to be abnormal when said detected result falls outside said prescribed range.~~

Claim 11 (Currently Amended) The circuit pattern inspection apparatus as defined in claim 9, wherein at least one of said supply and sensor electrodes which is to be moved by said second moving means includes an image pickup means method as recited in claim 9, wherein when said supply electrode and said sensor electrode are faced with each other at both ends of an inspection target pattern judged to be abnormal by said pattern inspection method, one of said supply means and said detection means is fixed and the other thereof is moved along said inspection target pattern to detect a position of said defect of said inspection target pattern based on a result detected by said sensor means.

Claim 12 (Currently Amended) The circuit pattern inspection apparatus as defined in claim 9, which includes a gap control means for positioning at least one of said supply and sensor electrodes which is to be moved by said second movement means, in such a manner as to allow a gap between said at least one electrode and said defective target pattern to be maintained at an approximately constant value method as recited in claim 11, wherein image taking means equipped on either one of moving support members for moving said supply electrode and said sensor electrode with said supply electrode and said sensor electrode mounted thereon is moved

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along said inspection target pattern toward the other moving support member to take an image of an abnormal state at an abnormal position of said inspection target pattern.

Claim 13 (Currently Amended) The circuit pattern inspection apparatus as defined in claim 1 or 2, which includes a gap control means for positioning at least one of said supply and sensor electrodes to be moved by said movement means, in such a manner as to allow a gap between said at least one electrode and each of said target patterns to be maintained at a constant value method as recited in any one of claims 9 to 12, wherein when said detection means or said supply means is moved, a displacement of a gap between said sensor electrode or said supply electrode and an inspection target pattern is detected, and wherein a positioning control is performed so that a detected gap is kept approximately constant to even results of said sensor electrode.

Claim 14 (Currently Amended) The circuit pattern inspection apparatus as defined in claim 12, wherein said gap control means includes a displacement measurement device disposed at a position adjacent to said sensor or supply electrode and adapted to be moved together with said sensor or supply electrode, said gap control means being operable to position said sensor or supply electrode in a direction orthogonal to said inspection region in accordance with a detection result of said displacement measurement device, in such a manner as to allow a gap between said sensor or supply electrode and said inspection region to be maintained at an approximately constant value method as recited in claim 11, wherein said positioning control

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with respect to said inspection target pattern is performed by assuming an average displacement of displacements between a plurality of pitches of said inspection target patterns as a distance between said sensor electrode or said supply electrode and said inspection target pattern.

Claim 15 (Currently Amended) A circuit pattern inspection apparatus for inspecting a plurality of target patterns having first and second opposite ends included in an inspection region thereof and arranged in lines, which is adapted to supply an AC inspection signal from the first end side of said inspection region of said target patterns, and detect a signal from the second end side of said inspection region, said circuit pattern inspection apparatus comprising:

supply means including a supply electrode for supplying said inspection signal from the first end side of said inspection region of said target patterns;

detection means including a sensor electrode for detecting a signal from each of said target patterns; and

moving means for moving said supply and sensor electrodes, respectively, across said first and second ends included in said inspection region and arranged in lines, with a given gap relative to each of said target patterns;

further including a determination means operable, when a detection result of said detection means based on a detection signal from one of said target patters is in a given acceptable range, to determine that said target pattern is normal, and, when a detection result of said detection means based on a detection signal from one of said target patters is out of said given acceptable range, to determine that said target pattern is defective;

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wherein said circuit pattern inspection apparatus includes:

second moving means for moving said supply and sensor electrodes to respective positions opposed to the first and second ends of said defective target pattern determined by said determination means, and moving either one of said supply and sensor electrodes along said defective target pattern toward the other electrode; and

position detection means for detecting a position where a detection signal from said defective target pattern has a change, in accordance with a detection result of said detection means;

wherein said circuit pattern inspection apparatus includes a gap control means for positioning at least one of said supply and sensor electrodes which is to be moved by said second movement means, in such a manner as to allow a gap between said at least one electrode and said defective target pattern to be maintained at an approximately constant value;

wherein said gap control means includes a displacement measurement device disposed at a position adjacent to said sensor or supply electrode and adapted to be moved together with said sensor or supply electrode, said gap control means being operable to position said sensor or supply electrode in a direction orthogonal to said inspection region in accordance with a detection result of said displacement measurement device, in such a manner as to allow a gap between said sensor or supply electrode and said inspection region to be maintained at an approximately constant value;

wherein said gap control means is operable to position said sensor or supply electrode in a direction orthogonal to said inspection region, on the basis of a gap between said sensor or

supply electrode and said inspection region which is defined by an average displacement of a detection result of said displacement measurement device obtained from a plurality of pitches of said target patterns[.]], wherein said gap control means is operable to position said sensor or supply electrode in a direction orthogonal to said inspection region, on the basis of a gap between said sensor or supply electrode and said inspection region which is defined by an average displacement of a detection result of said displacement measurement device obtained from a plurality of pitches of said target patterns.

Claim 16 (Previously Presented) A circuit pattern inspection method for use in a circuit pattern inspection apparatus which comprises supply means including a supply electrode for supplying an inspection signal to each of a plurality of target patterns having first and second opposite ends included in an inspection region thereof and arrange in lines, from the first end side of said inspection region, and detection means including a sensor electrode for detecting a signal from each of said target patterns, said circuit pattern inspection method comprising:

moving said supply and sensor electrodes relative to said target patterns, respectively, across said first and second ends included in said inspection region and arrange in lines, under the condition that each surface of said supply and sensor electrodes is spaced apart from each surface of said target patterns;

supplying an AC inspection signal from the first end side of said inspection region of said target patterns;

detecting a signal from each of said target patterns to inspect said target patterns; and

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maintaining a constant nonzero distance between said supply electrode and said sensor electrode, with respect to said target pattern, while inspecting said target pattern.

Claim 17 (Original) The circuit pattern inspection method as defined in claim 16, wherein each of said target patterns is a conductive pattern formed on a circuit board, said conductive pattern having a bar-like shape with a given width.

Claim 18 (Original) The circuit pattern inspection method as defined in claim 17, which includes:

allowing said sensor electrode to have a width equal to or greater than a width of two lines of said target patterns; and

detecting a signal from one of the adjacent target patterns a remaining one of which is supplied with the inspection signal, so as to allow the presence of short circuit between said adjacent target patterns to be determined.

Claim 19 (Original) The circuit pattern inspection method as defined in claim 16 or 17, which includes:

detecting a signal from one of the adjacent target patterns which is supplied with the inspection signal, through a first sensor electrode included in said sensor electrode so as to allow the presence of disconnection in said target pattern to be determined; and

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detecting a signal from a remaining one of said adjacent target patterns through a second sensor electrode included in said sensor electrode so as to allow the presence of short circuit between said adjacent target patterns to be determined.

Claim 20 (Previously Presented) The circuit pattern inspection method as defined in either one of claims 16 to 18, which includes determining a general position of a disconnected region in the target pattern in accordance with a position of said sensor electrode where said detection means has no detection signal.

Claim 21 (Previously Presented) The circuit pattern inspection method as defined in either one of claims 16 to 18, which includes evaluating whether a detection result of said detection means based on a detection signal from one of said target patters is in a given acceptable range, wherein when said detection result is in a given acceptable range, determining that said target pattern is normal, and, when said detection result is out of said given acceptable range, determining that said target pattern is defective.

Claim 22 (Original) The circuit pattern inspection method as defined in claim 21, which includes:

specifying a position of said defective target pattern determined by said determination means, and storing information about said position;

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moving said supply and sensor electrodes to respective positions opposed to the first and second ends of said defective target pattern in accordance with said stored information;

moving either one of said supply and sensor electrodes along said defective target pattern toward the other electrode; and

detecting a position where a detection signal from said defective target pattern has a change, in accordance with a detection result of said detection means, and defining said position as a defective position.

Claim 23 (Original) The circuit pattern inspection method as defined in claim 22, which includes bringing either one of said supply and sensor electrodes into contact with said defective target pattern.

Claim 24 (Previously Presented) The circuit pattern inspection method as defined in claim 22, which includes:

providing image pickup means in either one of said supply and sensor electrodes; and
moving said image pickup means together with said at least one electrode along said defective target pattern toward the other electrode.

Claim 25 (Previously Presented) The circuit pattern inspection method as defined in either one of claims 16 to 18, which includes;

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providing a displacement measurement device disposed at a position adjacent to said sensor or supply electrode and adapted to be moved together with said sensor or supply electrode; and

positioning said sensor or supply electrode in a direction orthogonal to said inspection region in accordance with a detection result of said displacement measurement device, in such a manner as to allow a gap between said sensor or supply electrode and said inspection region to be maintained at an approximately constant value, so as to provide a stable detection result of said detection means.

Claim 26 (Previously Presented) A circuit pattern inspection method for use in a circuit pattern inspection apparatus which comprises supply means including a supply electrode for supplying an inspection signal to each of a plurality of target patterns having first and second opposite ends included in an inspection region thereof and arranged in lines, from the first end side of said inspection region, and detection means including a sensor electrode for detecting a signal from each of said target patterns, said circuit pattern inspection method comprising:

moving said supply and sensor electrodes relative to said target patterns, respectively, across said first and second ends included in said inspection region and arranged in lines, under the condition that each surface of said supply and sensor electrodes is spaced apart from each surface of said target patterns;

supplying an AC inspection signal from the first end side of said inspection region of said target patterns; and

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detecting a signal from each of said target patterns to inspect said target patterns;
wherein said circuit pattern inspection method includes;
providing a displacement measurement device disposed at a position adjacent to said sensor or supply electrode and adapted to be moved together with said sensor or supply electrode;
and

positioning said sensor or supply electrode in a direction orthogonal to said inspection region in accordance with a detection result of said displacement measurement device, in such a manner as to allow a gap between said sensor or supply electrode and said inspection region to be maintained at an approximately constant value, so as to provide a stable detection result of said detection means;

which includes positioning said sensor or supply electrode on the basis of a gap between said sensor or supply electrode and said inspection region which is defined by an average displacement of a detection result of said displacement measurement device obtained from a plurality of pitches of said target patterns.

Claim 27 (New) The circuit pattern inspection apparatus as recited in claim 5, wherein said gap control means is equipped with a displacement measurement device disposed at a position adjacent to said sensor electrode or said supply electrode and adapted to be moved together with said sensor electrode or said supply electrode, and wherein said gap control means performs a positioning control in a direction orthogonal to said inspection target pattern in accordance with a detection result of said displacement measurement device so that a gap

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between said sensor electrode or said supply electrode and said inspection target pattern is kept approximately constant.

Claim 28 (New) The circuit pattern inspection apparatus as recited in claim 27, wherein said gap control means performs a positioning control in a direction orthogonal to said inspection target pattern, on the basis of a gap between said sensor or supply electrode and said inspection target pattern which is defined by an average displacement of detection results of said displacement measurement device between a plurality of pitches of said inspection target patterns.